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ABSTRACT

This teacher's guide is designed to accompany the Tractor Mechanic Competency Based Education (CBE) Curriculum (CE 022 480). The following information is included: a discussion of the uses of the Tractor Mechanic CBE curriculum; definitions of related terms; the table of contents for the Tractor Mechanic CBE curriculum; a list of competencies by job title; the self-tests which accompany selected student competency sheets; a tool list; and a list of references to accompany the curriculum. (BM)

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Teacher's Guide

# TRACTOR MECHANIC

Competency Based Education Curriculum

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This teacher's guide was developed at Virginia Polytechnic Institute and State University, Blacksburg, Virginia, through the cooperation and support of the Bureau of Vocational, Technical and Adult Education, State Department of Education, West Virginia.

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EDUCATION & WELFARE
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PREFACE

It is with the greatest pleasure that we bring you another West Virginia competency-based education (CBE) curriculum. This Tractor Mechanic curriculum was developed for West Virginia at Virginia Polytechnic Institute and State University, Blacksburg. Virginia. The effort was coordinated by staff of the Bureau of Vocational, Technical and Adult Education.

The Bureau began advocating CBE curriculum in 1974. Since that time West Virginia has produced over 20 CBE curricula in various occupational areas. We also have a number of CBE curricula currently in the process of being developed and/or field-tested.

This Tractor Mechanic curriculum was disseminated to West Virginia teachers through workshops in the Spring of 1979. Additional copies of this curriculum are available from:

Vocational Curriculum Laboratory
Cedar Lakes Conference Center
Ripley, West Virginia 25271

I trust this curriculum will help your program. Any suggestions you may have for improving it may be sent to our state Curriculum Lab. Through this feedback we plan to continually update our materials.

Clarence E. Burdette
Assistant State Superintendent of Schools
Bureau of Vocational, Technical and
Adult Education

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TEACHER'S GUIDE

-INTRODUCTION-

This teacher's guide is designed to accompany the Tractor Mechanic Competency Based Education Curriculum. It has been developed in order to facilitate vocational agricultural mechanics instructors use of the curriculum.

The competency sheets are intended for use by both students and instructors. This teacher's guide contains an explanation of the curriculum, a test of "Competencies, by Job Title", suggested student Self Test on additional handouts, a tool list, and a list of references to accompany the curriculum.

# A C K N O W L E D G E M E N T S

The development of this competency based educational curriculum has been a joint effort of many individuals. It will not be possible to mention all of them, however, the writer would like to take this opportunity to mention individuals and groups of individuals whose valuable contributions have made the completion of the Tractor Mechanic Curriculum possible.

The West Virginia tractor dealers and mechanics, vocational agriculture mechanics instructors, and agricultural education and engineering faculty from the University of West Virginia, who served as consultants and offered valuable suggestions concerning the competencies to be taught have proved most helpful.

Mr. Mike Kubina, Ripley, West Virginia; Mr. Charles E. Larew, Union High School, Union, West Virginia; Mr. Ed Rayl, Braxton County High School, Sutton, West Virginia; Mr. William R. Reasor, DWC Vocational Career Center, Harrisville, West Virginia; Mr. Charles W. Stemple, Preston County Educational Center, Kingwood, West Virginia; and Mr. Alan Paul Whetzel, Mineral County Vocational Technical School, Keyser, West Virginia who received portions of the curriculum and whose advice was most valuable in the preparation of the teacher's guide.

Appreciation is extended to Dr. Fred Harrington, Coordinator of Curriculum Development; Mr. Donald L. Michael, State Supervisor, Vocational Agriculture, Mr. William C. West, Program Specialist, Vocational

Agriculture, Mr. Larry Frochlich, Curriculum Specialist, Vocational Curriculum Laboratory, and other co-workers on the West Virginia State Board of Education, the staff in Vocational Agriculture Education and to others who made a contribution to the preparation and development of this curriculum.

The writer would like to extend a special word of appreciation to Dr. Thomas A. Silletto, Assistant Professor, and Dr. John H. Hillison, Associate Professor, both faculty members of the Division of Vocational and Technical Education at Virginia Polytechnic Institute and State University, Blacksburg, Virginia. Dr. Silletto's contribution through his technical knowledge, editing, and professional advice were a great help in the development of the curriculum and teacher's guide. Dr. John Hillison's contributions through his proofreading and editing, professional advice, knowledge and support were priceless in the development of the teacher's guide and the curriculum.

The curriculum could not have been completed if it had not been for the help of the typists: Mrs. Sherry Crunkilton, Ms. Millie Linkous, and Mrs. Connie Ghee, and the proofreader Ms. Karen Finch.

## V-TECS ACKNOWLEDGEMENTS

The majority of the unit titles, competencies, performance objectives, performance guides and criterion evaluations presented in the curriculum were selected from the V-TECS catalog "Tractor Mechanic". This V-TECS catalog was developed by Dr. Bruce C. Carpenter, Mr. James D. Maddox, Ms. Elsie Kennedy and Dr. Maynard Iverson in May of 1975 at the University of Kentucky.

USES OF THE

TRACTOR MECHANIC

COMPETENCY BASED EDUCATION CURRICULUM

Competency based education has advantages that many of today's educators sometimes fail to recognize. The purpose for developing this curriculum was not to replace the current overall program, but to offer teachers a resource that can be used in numerous ways to up-date and improve present tractor mechanic curriculums.

The student's progress in a competency based class is dependent upon performance, not seat time. This allows the students who are already qualified in a particular area of instruction to either do more intensive work in that area or to progress on to another area of study. Students who are slow learners are now allowed to become competent at job entry skills, eliminating the problem many instructors face of slow learners hampering the class progress. If students have to miss a class period, they can still make up the work because the individual competency sheets do not need the specialized attention of the instructor as do traditional methods of instruction. The open entry - open exist concept of this curriculum allows for students who enter the class late, to be able to pick up where the rest of the class is and not have to worry about information missed from previous lessons. This is due to the fact that the student's learning is associated with individual objectives, not instructional materials.

By allowing student's learning to be tied to objectives rather than instructional materials, the instructor can now develop an efficient multiple station approach in the tractor mechanic's laboratory. No longer do the students all have to work on the same project at the same time. At the various stations in the laboratory, students, through the use of this curriculum, can do more specialized project work such as overhauling an engine or participate in a one-time learning experience such as "honing-a-cylinder" without the constant supervision and instruction from the teacher.

This constant supervision is no longer necessary due to the manner in which the curriculum was constructed. The curriculum itself can be a reference for teachers when developing their program of study. No teacher will probably ever use every competency sheet developed for this curriculum. They are not expected to, due to the physical limitations of their equipment and facilities. Teachers are now able to pick from the overall curriculum those competencies they feel should and can be taught in their particular program. Once the competencies have been selected for the program the teacher can read over the individual sheets and prepare for both demonstrations and lectures without a lot of intense reading and planning. The competency sheets were constructed in this manner so that they would be a great time saver for both the student and instructor. The pre-test and post-test design of the competency sheet allows the instructor to spend more time in instruction than in evaluation. Each competency sheet has a section of learning activities to be done by an individual student or by a group of students. The instructor has the prerogative of assigning to any student all of the learning activities listed or any that would be

appropriate to fit the needs of either the individual student or a group of students. The performance guide accompanying every competency sheet gives the learner a step-by-step guide for hands on experience in order to master each of the competencies. The evaluation of the student's work is also taken into account by this curriculum. Each student must complete a competency under the same standards as any other student, thus there is more objectivity in evaluating the students. Contract grading is an often recommended form of evaluation to use with competency based education. This allows for a fairness for the special needs student, the average student, as well as the gifted student.

Teachers who use this curriculum may find many advantages other than those of high school instruction. The way the curriculum is structured a teacher could easily adapt portions of it to form a course of study. Adults who want one-time instruction in the field of tractor mechanics can now obtain it my simply studying one or more of the competency sheets. The intensive information contained in the curriculum could also be used to help establish an adult program. Since the curriculum materials take little time to prepare for a class period, this curriculum would make the substitute teacher's job a lot easier and more effective.

The effects of this curriculum, if used correctly, could build public relations with local school administrators, guidance personnel, other teachers, parents, and local business people. These people now have the opportunity to see, in a very clear fashion, what is being taught.

Once the local business people understand the program the teacher is operating at the local school, they will tend to be more supportive of co-op programs. The businessmen now will know what the students can

do and what they cannot. The possibilities for "on-the-job-training" under the competency based educational system are greater than those of the traditional system.

One of vocational education's main goals is to prepare people for employment. This includes introducing students to what the occupation is about, how students can find employment, and preparing them to be competent in the basic job-entry skills. This curriculum deals in one way or another with each of these areas. Employers are looking for prospective employees that have a good attitude toward work. Teachers who use this curriculum in classes may find out that not only do students learn to read and follow directions better, but they also learn how to think logically, develop good work habits, and pride in their work.

This curriculum is not designed to cure all of the everyday problems encountered in the classroom and laboratory. It does offer some aids, that when used correctly, can help correct some of these problems.

This Competency Based Education curriculum allows the student's progress to be dependent upon their performance, not seat-time. The learning is keyed on objectives not instructional materials. The instructor now has to make a more careful choice of course content and course selection. The instructor exhibits more objectivity in evaluating the students. The curriculum can help the instructor involve the business world in the overall development of the classroom and laboratory program. Due to the fact that the responsibility for learning shifts from the teacher to the student, the students now can progress at their own rate.

## DEFINITION OF TERMS

COMPETENCY: A knowledge, skill or judgement which the learner will demonstrate at a pre-determined level.

CRITERION EVALUATION: The evaluation procedure may be the degree of acceptable performance. It may be quantitative, qualitative, or both. If the measure of quality is highly subjective, the instructor is assumed to be the judge of acceptable performance unless otherwise stated. The judgement may be made in the form of acceptable or not acceptable, or it may be made by using a checklist.

LEARNING ACTIVITIES: Made up of activities and resources which will assist the learners in mastering the competencies. These learning activities can range from large group activities to small group activities.

PERFORMANCE GUIDE: A listing of steps in sequential order which the student must perform in achieving an objective.

PERFORMANCE OBJECTIVE: A statement of the precise behavior to be exhibited by a learner under specified conditions. It possesses each of the elements or characteristics mentioned below.

1. Condition - the testing situation confronting the learner is clearly specified. This includes equipment provided.
2. Performance - the specific behavior expected of the learner is stated.

SUPPLEMENTAL READINGS: Any additional references that could prove to be beneficial to the learner or instructor for greater intensified instructional and learning purposes.

UNIT: One of the major activities involved in the work performed, comprising related tasks.

TRACTOR MECHANIC CURRICULUM

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## COMPETENCIES BY JOB TITLE

Satisfactory completion of all competencies of this curriculum should allow the student to begin working at any of the following jobs.

1. Parts Salesperson: person that not only has a good general knowledge of power machinery parts, but also how the parts are to be correctly installed.

2. Auto Mechanic, Assistant: capable of assisting auto mechanic in any task. Has a good overall understanding of the principles and procedures needed to be an auto mechanic.

3. Tractor Mechanic, Assistant: capable of assisting tractor mechanic in any task. Has a good overall understanding of the principles and procedures needed to be a tractor mechanic.

4. Truck Mechanic, Assistant: capable of assisting truck mechanic in any task. Has a good overall understanding of the principle and procedures needed to be a truck mechanic.

5. Diesel Engine Mechanic, Assistant: capable of assisting a diesel engine mechanic in any task. Has a good overall understanding of the principles and procedures needed to be a diesel engine mechanic.

6. Transmission Specialist, Assistant: capable of assisting transmission specialist or mechanic with any form of transmission repair or maintenance. Has a good understanding of the principles and procedures needed to be a transmission specialist.

7. Hydraulic Specialist, Assistant: capable of assisting hydraulic specialist or mechanic with any form of hydraulic system repair or maintenance. Has a good understanding of the principles and procedures needed to be a hydraulic specialist.

8. Power Mechanics Electrical Specialist, Assistant: capable of assisting power mechanics electrical specialist or mechanic with any form of electrical repair or maintenance. Has a good understanding of the principles and procedures needed to be a power mechanics electrical specialist.

Students will be prepared for the following jobs upon completion of the specified competencies:

1. Shipping and Receiving Clerk: receives and sends merchandise

(i.e., power machinery parts and supplies). Should have a general knowledge of how merchandise is to be shipped and received.

Competencies to be completed:

1. Inspect new tractor parts for shipping damage
2. Look for a job
3. Write a personal data sheet
4. Prepare for a job interview
5. Complete a job application

2. Body Repair person, Assistant: capable of assisting body repair person in any task dealing with body work. Has a good understanding of body work.

Competencies to be completed:

1. Prepare tractor for steam cleaning
2. Clean tractor with steam cleaner
3. Prepare steam cleaner for shutdown
4. Prepare tractor for painting
5. Paint tractor
6. Look for a job
7. Write a personal data sheet
8. Prepare for job interview
9. Complete a job application

3. Painter, Assistant: capable of assisting painter in any task dealing with painting. Has a good understanding of the principles and procedures needed to be a painter.

Competencies to be completed:

1. Prepare tractor for steam cleaning
2. Clean tractor with steam cleaner
3. Prepare steam cleaner for painting
4. Prepare tractor for painting
5. Paint tractor
6. Look for a job
7. Write a personal data sheet
8. Prepare for job interview
9. Complete a job application

4. Shop Worker: capable of performing the basic skills needed in industry in the field of power mechanics.

Competencies to be completed:

1. Check tires for pressure, wear and defects
2. Inspect new tractor parts for shipping damage

3. Prepare tractor for steam cleaning
4. Clean tractor with steam cleaner
5. Prepare steam cleaner for shutdown
6. Prepare tractor for painting
7. Paint tractor
8. Service air cleaner (oil bath)
9. Service air cleaner (dry)
10. Service drive shafts
11. Service special drives (belt, chain, gear and variable speed)
12. Service universal joints
13. Activate dry charged batteries
14. Charge a wet cell battery
15. Tighten battery cables and hold-down
16. Treat battery terminals to prevent corrosion
17. Jump start a battery with jumper cables
18. Determine battery condition by use of a hydrometer
19. Replace primary ignition wire
20. Replace secondary ignition wire
21. Service spark plugs
22. Flush and clean the radiator
23. Replace radiator hose
24. Service fan belts
25. Replace cooling system thermostat
26. Replace amperage gauge
27. Check ignition switch
28. Check safety switches
29. Check solenoid
30. Change oil filters
31. Change tractor oil (engine and/or transmission)
32. Check engine crankcase oil level
33. Check transmission and/or differential lubricant levels
34. Drain and refill differentials
35. Clean and flush hydraulic systems
36. Drain and refill hydraulic system
37. Look for a job
38. Write a personal data sheet
39. Prepare for job interview
40. Complete a job application

5. Set-up and Delivery Person: capable of successfully testing, analyzing, and performing preparatory tasks for the mechanic.

Competencies to be completed:

1. Check tires for pressure, wear and defects
2. Check torque converter with test equipment
3. Inspect new tractor parts for shipping damage
4. Prepare tractor for steam cleaning
5. Clean tractor with steam cleaner

6. Prepare steam cleaner for shutdown
7. Prepare tractor for painting
8. Paint tractor
9. Service air cleaner (oil bath)
10. Service air cleaner (dry)
11. Test engine compression
12. Use the dynamometer
13. Activate dry charged batteries
14. Charge a wet-cell battery
15. Clean battery terminals, cables, and battery box
16. Measure the voltage of a battery using the voltmeter
17. Run a load test on a battery using a hydrometer, load test machine and voltmeter.
18. Run a load test on a battery using a hydrometer and voltmeter
19. Tighten battery cables and battery hold-down
20. Treat battery terminals to prevent corrosion
21. Jump-start a battery with jumper cables
22. Determine battery condition by use of a hydrometer
23. Measure resistance using ohmmeter
24. Replace primary ignition wire
25. Replace secondary ignition wire
26. Service spark plugs
27. Set ignition timing using a timing light
28. Set breaker point dwell using a duel meter
29. Test distributor advance mechanism
30. Test and replace ignition coil
31. Test ignition distributor
32. Flush and clean radiator
33. Replace radiator hose
34. Service fan belts
35. Test cooling system for leaks
36. Test radiator coolant
37. Test radiator pressure cap
38. Test thermostat
39. Check armature and fields of charging circuit
40. Polarize a tractor generator
41. Test a tractor generator on a bench using the test for the common A circuit generator
42. Replace amperage gauge
43. Test alternator diodes
44. Test charging circuit using a voltmeter, ammeter, and/or carbon pile
45. Check armature and fields of the starting circuit
46. Check ignition switch
47. Check safety switches
48. Check solenoid
49. Clean carburetor
50. Clean settling bulb (sediment bowl)
51. Time fuel injector pump to engine
52. Check cylinder head and block for warpage

53. Check cylinder block, oil passages and piston
54. Measure bearing clearance
55. Measure camshaft for wear
56. Measure and record crankshaft main and rod journals
57. Measure cylinder taper
58. Measure piston-ring end gap
59. Measure piston-ring land clearance
60. Measure valve-stem guide clearance
61. Test valve springs
62. Change oil filters
63. Change tractor oils (engine and/or transmission)
64. Check engine crankcase oil level
65. Check transmission and/or differential lubricant levels
66. Drain and refill differentials
67. Change hydraulic filters
68. Clean and flush the hydraulic system
69. Drain and refill hydraulic system
70. Look for a job
71. Write a personal data sheet
72. Prepare for a job interview
73. Complete a job application form

6. Common Laborer: similar to the shop worker. Occupation requires lesser skills than that of the shop worker.

Competencies to be completed:

1. Check tires for pressure, wear and defects
2. Inspect new tractor parts for shipping damage
3. Prepare tractor for steam cleaning
4. Clean tractor with steam cleaner
5. Prepare steam cleaner for shutdown
6. Prepare tractor for painting
7. Paint tractor
8. Service air cleaner (oilbath)
9. Service air cleaner (dry)
10. Clean battery terminals, cables, and battery box
11. Tighten battery cables and battery hold down
12. Treat battery terminals to prevent corrosion
13. Jump start a battery with jumper cables
14. Flush and clean the radiator
15. Change oil filters
16. Change tractor oil (engine and/or transmission)
17. Check engine crankcase oil level
18. Change hydraulic filters
19. Clean and flush the hydraulic system
20. Look for a job
21. Write a personal data sheet
22. Prepare for a job interview
23. Complete a job application

# TRACTOR MECHANIC COMPETENCIES

## EMPLOYMENT OPPORTUNITIES

1. Look for a job
2. Write a personal data sheet
3. Prepare for job interview
4. Complete a job application

## PERFORMING GENERAL SKILLS

1. Adjust wheel bearings
2. Check tires for pressure, wear and defects
3. Check torque converter with test equipment
4. Inspect new tractor parts for shipping damage
5. Prepare tractor for steam cleaning
6. Clean tractor with steam cleaner
7. Prepare steam cleaner for shutdown
8. Prepare tractor for painting
9. Paint tractor
10. Repair brake assemblies
11. Service air cleaner (oilbath)
12. Service air cleaner (dry-type)
13. Service drive shafts
14. Service an engine governor
15. Service hydraulic governor (diesel)
16. Service power take-off drive
17. Service special drives (belt, chain, gear and variable speed)
18. Service universal joints
19. Test engine compression
20. Use the dynamometer

## MAINTAINING AND SERVICING STORAGE BATTERY

1. Activate dry charged batteries
2. Charge a wet-cell battery
3. Clean battery terminals, cables, and battery box
4. Measure the specific gravity using a hydrometer
5. Measure the voltage of a battery using the voltmeter
6. Run a load test on a battery
7. Run a load test on a battery using the starter motor
8. Tighten battery cables and battery hold-down
9. Treat battery terminals to prevent corrosion
10. Jump-start a battery using jumper cables

TRACTOR MECHANIC COMPETENCIES

MAINTAINING AND SERVICING THE IGNITION CIRCUIT

1. Measure resistance using ohmmeter
2. Replace distributor points and condenser
3. Replace ignition distributor
4. Replace primary ignition wire
5. Replace secondary ignition wires
6. Service spark plugs
7. Set breaker point dwell using a dwell meter
8. Set ignition timing using a timing light
9. Test distributor advance mechanism
10. Test and replace ignition coil
11. Test ignition distributor

MAINTAINING AND SERVICING THE COOLING SYSTEM

1. Flush and clean the radiator
2. Replace radiator hose
3. Replace water pump
4. Service fanbelts
5. Test cooling system for leaks
6. Test radiator coolant
7. Test radiator pressure caps
8. Replace cooling system thermostat
9. Test thermostat

MAINTAINING AND SERVICING THE CHARGING CIRCUIT

1. Adjust voltage regulator using fixed resistance method
2. Adjust voltage regulator using variable resistance method
3. Check armature and fields
4. Polarize a tractor generator
5. Test a tractor generator on a bench using the test for the common A circuit generator
6. Replace amperage gauge
7. Replace bearings (alternator or generator)
8. Replace diodes
9. Replace generator brushes
10. Replace heat sink
11. Service the alternator regulator
12. Test alternator diodes
13. Test charging circuit using a voltmeter, ammeter, and/or carbon pile
14. Turn armature

TRACTOR MECHANIC COMPETENCIES

MAINTAINING AND SERVICING THE STARTING CIRCUIT

1. Check armature and fields
2. Check ignition switch
3. Check safety switches
4. Check solenoid
5. Replace bearings and bushings
6. Replace ring gear
7. Replace starter brushes
8. Replace starter drive
9. Replace starter motor solenoid
10. Replace starter motors
11. Turn armature

MAINTAINING AND SERVICING GASOLINE FUEL SYSTEM

1. Adjust carburetor float
2. Adjust carburetor idle air/fuel mixture
3. Adjust engine idle speed
4. Clean carburetor
5. Clean settling bulb (sediment bowl)
6. Install carburetor repair kit
7. Replace fuel pump
8. Service a fuel pump (diaphram type)
9. Service fuel tanks and fuel lines

MAINTAINING AND SERVICING DIESEL FUEL SYSTEM

1. Bleed a diesel fuel system
2. Service diesel fuel filters
3. Service a diesel fuel injector
4. Service the diesel-injection pump
5. Service a diesel-transfer pump
6. Remove turbochargers
7. Time fuel injector pump to engine

TRACTOR MECHANIC COMPETENCIES

MAINTAINING AND SERVICING BASIC ENGINE

1. Adjust valve clearance
2. Check cylinder head and block for warpage
3. Check cylinder block, oil passages and piston
4. De-glaze cylinder
5. Grind valves
6. Install connecting rods caps
7. Install a crankshaft
8. Install cylinder heads
9. Install front oil seals
10. Install main bearings and caps
11. Install piston assembly
12. Install rear-main oil seals
13. Install rod bearings
14. Install timing chain or gears
15. Measure bearing clearance
16. Measure camshaft for wear
17. Measure and record crankshaft main and rod journals
18. Measure cylinder taper
19. Measure piston-ring end gap
20. Measure piston-ring land clearance
21. Measure valve-stem guide clearance
22. Reface valve seats
23. Remove carbon from ring grooves
24. Remove cylinder ridge
25. Remove piston assembly
26. Replace camshaft bearings
27. Replace dry sleeves
28. Replace oil pan gasket assembly
29. Replace piston rings
30. Replace rear engine oil seal
31. Replace rocker arms
32. Replace valve guides
33. Replace wet sleeves
34. Service intake manifold
35. Test valve springs
36. Torque main bearings

MAINTAINING AND SERVICING LUBRICATION SYSTEM

1. Change oil filters
2. Change tractor oils (engine and/or transmission)
3. Check engine crankcase oil level
4. Check transmission and/or differential lubricant levels
5. Drain and refill differentials
6. Pack wheel bearings
7. Service oil coolers
8. Service oil pumps
9. Check transmission and/or differential lubricant levels on a plug equipped engine

TRACTOR MECHANIC COMPETENCIES

MAINTAINING AND SERVICING CLUTCHES

1. Adjust clutch free play
2. Service a dry clutch
3. Service an expanding shoe clutch
4. Service a magnetic clutch
5. Service an overrunning clutch
6. Service a wet clutch

MAINTAINING AND SERVICING HYDRAULICS

1. Change hydraulic filters
2. Clean and flush the hydraulic system
3. Drain and refill hydraulic system
4. Operate and analyze with a hydraulic tester
5. Repair hydraulic-assist transmissions
6. Maintain and repair hydraulic cylinders
7. Replace hydraulic fittings
8. Service and adjust hydraulic-assist transmissions
9. Service and repair hydraulic gear pump
10. Service and repair radial piston pump
11. Service and repair hydraulic motor
12. Service and repair hydrostatic drive
13. Service and repair hydraulic pumps
14. Service and repair hydraulic valves
15. Service and repair internal hydraulic pump
16. Trouble-shoot a hydraulic-assist transmission

MAINTAINING AND SERVICING POWERTRAIN

1. Measure backlash and clearance in gear train
2. Measure end-play and adjust movement in gear shift
3. Preload bearings in gear train
4. Service constant mesh transmission (Example: Ford)
5. Service power-shift transmission
6. Service sliding-gear transmission

MAINTAINING AND SERVICING DIFFERENTIALS

1. Correct adjustment of ring gear and pinion
2. Preload bearings
3. Repair differentials
4. Replace brake and axle seals and gaskets
5. Service differential locks (mechanical, hydraulic)

TRACTOR MECHANIC COMPETENCIES

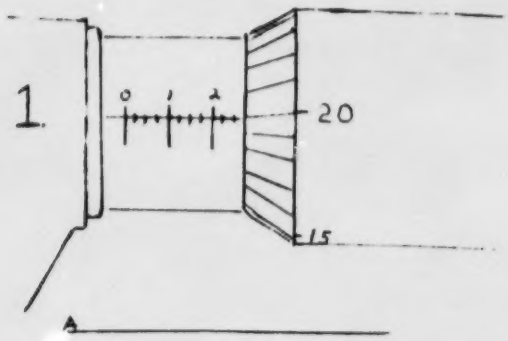
MAINTAINING AND SERVICING FINAL DRIVE

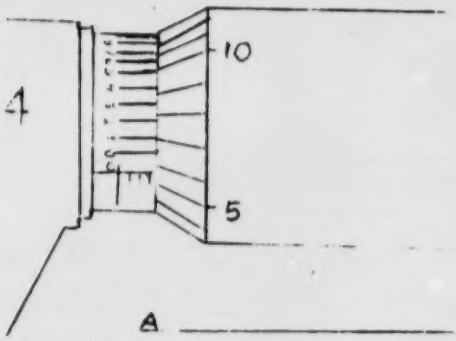
1. Adjust chain drive in final drive
2. Adjust end play in final drive
3. Preload and install bearings in final drive
4. Service final drives
5. Service inboard and outboard mounted planetary drives

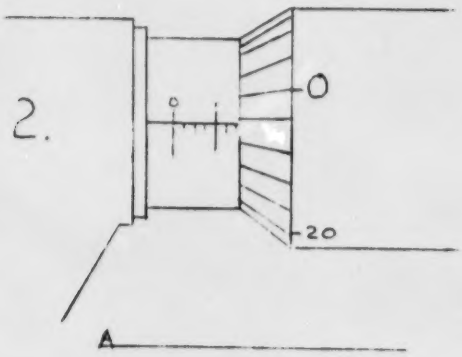
This self test can be used along with the Competency Sheet - TURN AN ARMATURE*

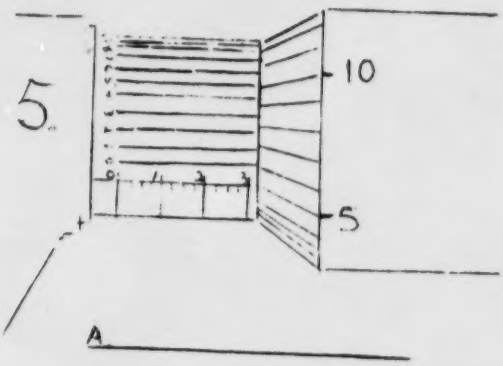
READING A MICROMETER

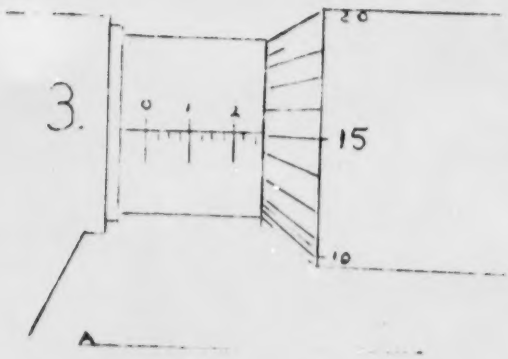
Complete the readings for each of the micrometer settings shown below. Jot your answer in the space below each example.

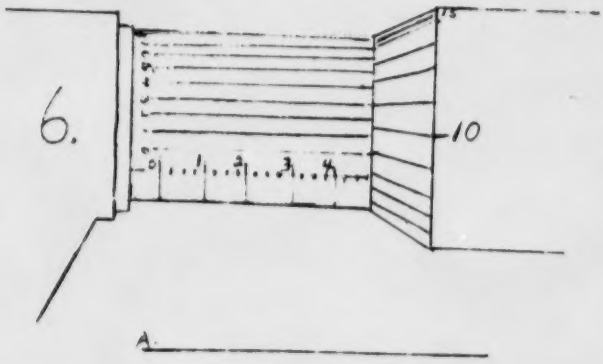


Compare your answers with the correct responses. Review any incorrect answers before going on to the next Learning Activity.

Correct Responses

1. .295 inch 2. .164 inch 3. .265 inch 4. .0801 inch
5. .3055 inch 6. .4823 inch

*Courtesy of the Kentucky Bureau of Vocational Education, State Department of Education and the Department of Vocational Education, College of Education, University of Kentucky.

This self-test is to be used along with the Competency Sheet - PRELOAD AND INSTALL BEARINGS IN THE FINAL DRIVE*

1. Which of the following can cause final drive failure?

   a. overheating
   b. lack of lubrication
   c. excessive drive shaft end-play
   d. all of these
   e. none of these

2. A continuous noise or knock is a good sign of loose or damaged bearings. (True or False)

3. Readjustment of bearings that are worn or damaged should provide satisfactory service. (True or False)

4. Describe what a worn bearing roller could look like compared to a new bearing.

5. What causes overheating in the final drive bearings?

ANSWERS

1. E
2. True
3. False-replace the bearings
4. The worn bearing shoulders are worn as compared to a new bearing.
5. By letting the lubricant level get too low or by using the wrong type of lubricant.

*Courtesy of the Bureau of Vocational Education, State Department of Education and the Department of Vocational Education, College of Education, University of Kentucky

This self-test is to be used along with the Competency Sheet - SERVICE A DRY CLUTCH

DIAGNOSING PROBLEMS IN CLUTCHES

1. List as many causes for each of the following clutch troubles as you can.

   a. Chattering: _____

   _____

   b. Dragging: _____

   _____

   c. Squeaks: _____

   _____

   d. Rattles: _____

   _____

   e. Grabbing: _____

   _____

   f. Slipping: _____

   _____

   g. Vibrating: _____

   _____

   h. Failure: _____

   _____

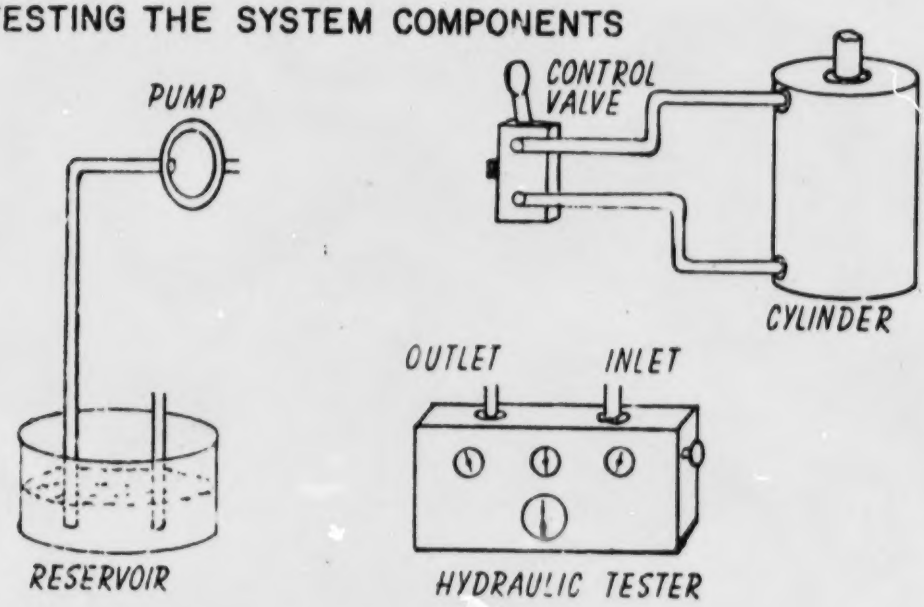
Compare your answers with the correct ones in Fundamentals of Service: Power Trains, Chapter 2, pages 17 and 18. If you were not able to list at least two items in each category, or if you missed any items, review the material before going on to the next learning activity.

*Courtesy of the Bureau of Vocational Education, State Department of Education and the Department of Vocational Education, College of Education, University of Kentucky.

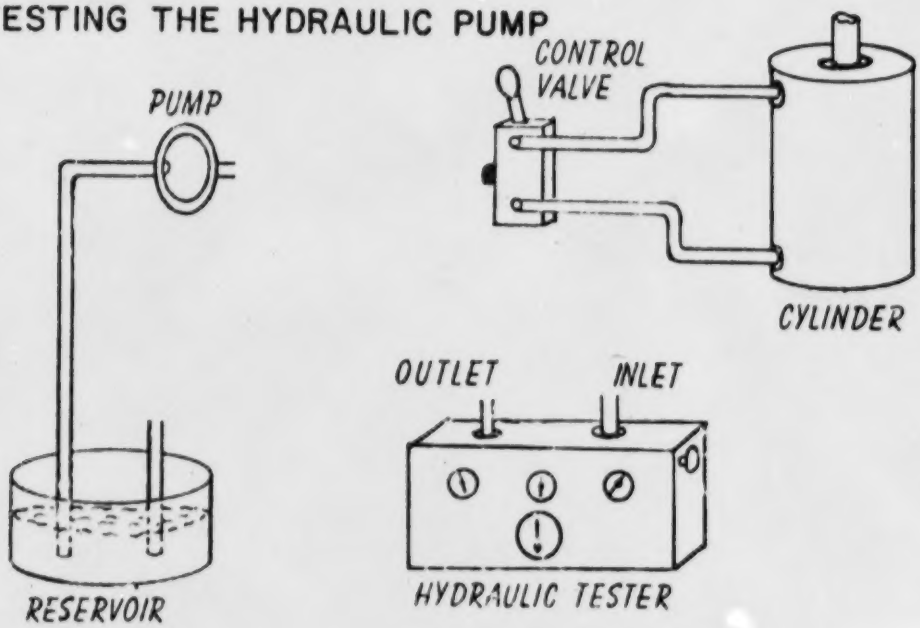
This self-test can be used along with the Competency Sheet -
OPERATE AND ANALYZE WITH THE HYDRAULIC TESTER*

1. Draw in the lines from the inlet and the outlet of the hydraulic tester to the correct lines in the system for proper testing.

## TESTING THE SYSTEM COMPONENTS



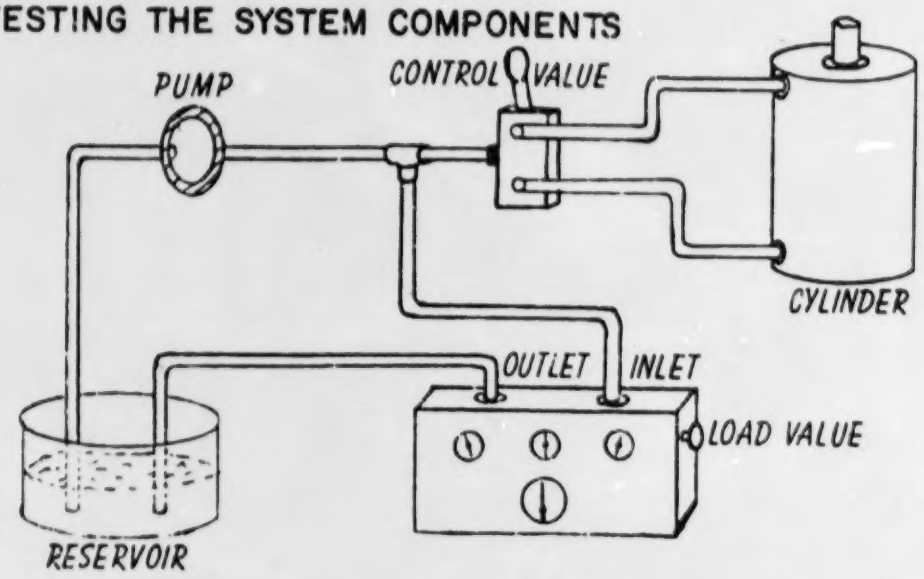

## TESTING THE HYDRAULIC PUMP



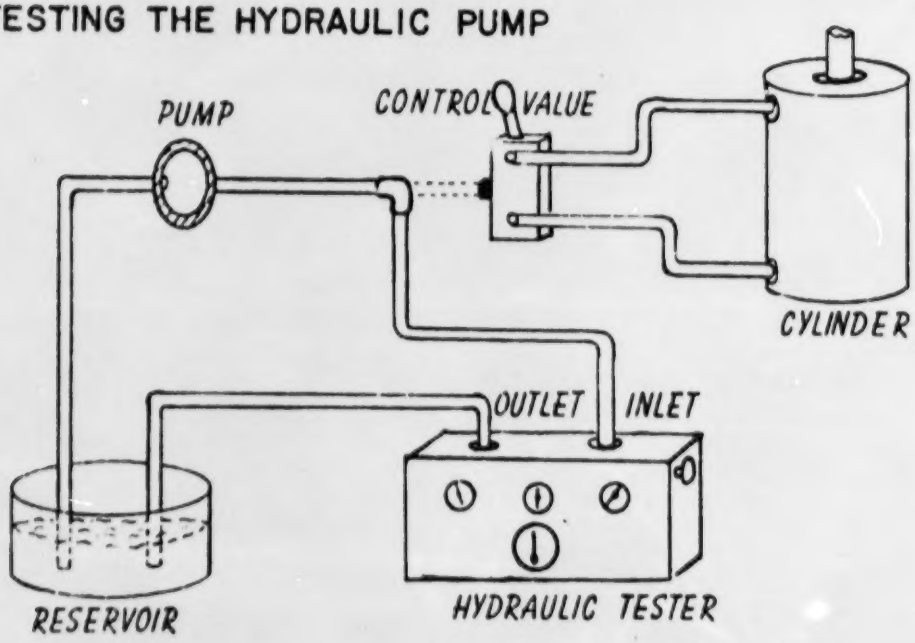

(Continued on the next page.)

Compare your drawing with the correct diagram below. Make sure you understand how to attach a hydraulic tester before going on to the next learning activity.

TESTING THE SYSTEM COMPONENTS




TESTING THE HYDRAULIC PUMP




(Continued on the next page.)

## OPERATE AND ANALYZE WITH THE HYDRAULIC TESTER

Answer the following questions. Then compare your answers with those at the bottom of the page.

2. Test the hydraulic system flow first so that you have a guide for reading on the pump flow test. (True or False)

3. What is the worst enemy of the hydraulic system?_____

4. How do you know if a hydraulic circuit is good?_____

_____

5. If the flow drops the same on all circuits, what would you expect the trouble to be?_____

_____

ANSWERS

2. False. Test the pump first. It is the generating force for the whole system and affects the operation of all other system components.
3. Dirt
4. If the circuit's flow is the same as for the pump.
5. The relief valve may be malfunctioning.

*Courtesy of the Kentucky Bureau of Vocational Education, State Department of Education and the Department of Vocational Education, College of Education, University of Kentucky.

To be used with the Competency Sheet -
OPERATE AND ANALYZE WITH A HYDRAULIC TESTER

RECORDING HYDRAULIC TEST RESULTS

Tractor Model_____ Owner_____

Serial Number_____ Comments_____

Equipment Used_____

| | | GALLONS PER MINUTE @ PSI | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 250 | 500 | 750 | 1000 | 1250 | 1500 | 1750 |
| Pump Test | | | | | | | | | |
| Circuit Test | Direction Cylinder Travel | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| |

This self-test can be used along with the Competency Sheet -
SERVICE A DIESEL INJECTION PUMP*

Answer the following:

1. If the injection pump is made up of injector nozzle and pump, there is no high pressure line. (T or F)

2. What are the functions of the injector system?
   a.
   b.
   c.
   d.
   e.

3. Pressures of up to 5000 PSI can be reached by some fuel injection pumps. (T or F)

4. The three main types of injection systems are:
   a.
   b.
   c.

5. The four major ways of injecting fuel are:
   a.
   b.
   c.
   d.

Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. False 2. a) Supply the correct amount of fuel; b) Time fuel delivery; c) Control rate of delivery; d) Atomize fuel; e) Distribute fuel in combustion chamber. 3. True 4. a) Common rail, b) Accumulator, c) Jerk pump. 5. a) Individual pump and nozzle; b) Combined pump and nozzle; c) Pumps in common housing, nozzles for each cylinder; d) One pump serving nozzles for several cylinders.

*Courtesy of the Kentucky Bureau of Vocational Education, State Department of Education and the Department of Vocational Education, College of Education, University of Kentucky.

This self-test can be used along with the Competency Test - SERVICE THE INTAKE MANIFOLD*

1. Every 50 hours, check the intake manifold for restrictions or air leaks. (True or False)

2. Why do gasoline engines have the exhaust and intake manifold made into one piece?

3. How should you check the intake manifold for warpage?

4. In diesel engines the intake manifold is usually located on the opposite side of the engine to the exhaust manifold. (True or False)

5. Which of the following is (are) not a part of the intake system?

   a. muffler
   b. turbocharger
   c. air cleaner
   d. carouretor

6. What are the torque specifications for the manifold and carburetor which you are going to be servicing?

ANSWERS:

1. True
2. So the heat from the exhaust manifold will help to vaporize the fuel in the intake manifold.
3. Lay a straight-edge across the manifold and use a feeler gauge.
4. True
5. a. Muffler
6. Answers will be found in the manufacturer's service manual.

*Courtesy of the Kentucky Bureau of Vocational Education, State Department of Education and the Department of Education, College of Education, University of Kentucky.

This self-test is to be used along with the competency sheet - SERVICE AND REPAIR AN INTERNAL HYDRAULIC PUMP.*

Answer the following:

1. Hydraulic pumps convert _____ force into _____ power.

2. A hydraulic pump creates flow, not pressure. (True or False)

3. Hydraulic pumps work on a principle called displacement. The two types of displacement are _____ and _____.

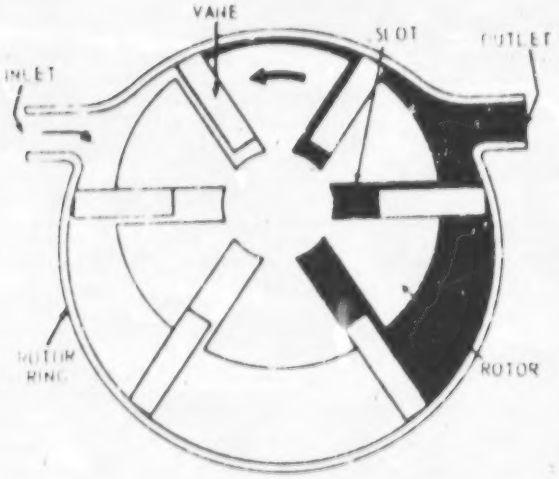
4. Which type of displacement is used in modern hydraulic pumps?

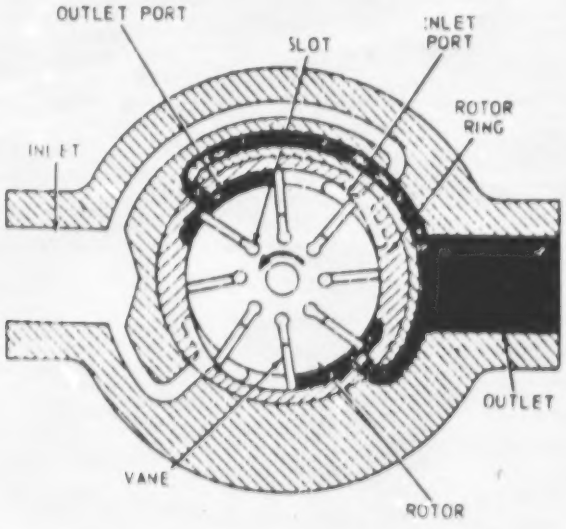
   Why?

5. The three types of hydraulic pumps are _____, _____ and _____.

6. What are the differences between an external gear pump and an internal gear pump?

7. Label the following sketches as to whether they are balanced or unbalanced vane pumps.




a. _____

b. _____

SERVICE AND REPAIR AN INTERNAL HYDRAULIC PUMP

8. If the pistons of a piston pump are mounted in lines parallel with the pump's axle, it is a _____ piston pump.

9. If the pistons of a piston pump are set perpendicular to the pump's center, it is a _____ piston pump.

10. The swashplate in a piston pump can be stationary or movable. (True or False)

Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before going on to the next learning activity.

Correct Responses

1. Mechanical, hydraulic
2. True
3. Positive and non-positive
4. Positive, provides a full flow or fluid through the system by preventing feedback
5. Vane, gear, and piston
6. Internal pump has two gears--one positioned and inside the other. External pump has two gears positioned in mesh with each other.
7. a. Unbalanced
   b. Balanced
8. Axial piston pump
9. Radial piston pump
10. True

*Courtesy of the Bureau of Vocational Education, State Department of Education and the Department of Vocational Education, College of Education, University of Kentucky.

This self-test can be used along with the Competency Sheet - REMOVE PISTON ASSEMBLY.*

Complete the following:

1. When removing piston rings, the mechanic should replace only the damaged ones. (True or False)

2. Why should the mechanic mark the position of each connecting rod and piston when removing them from the engine?

3. What are the functions of the compression rings?

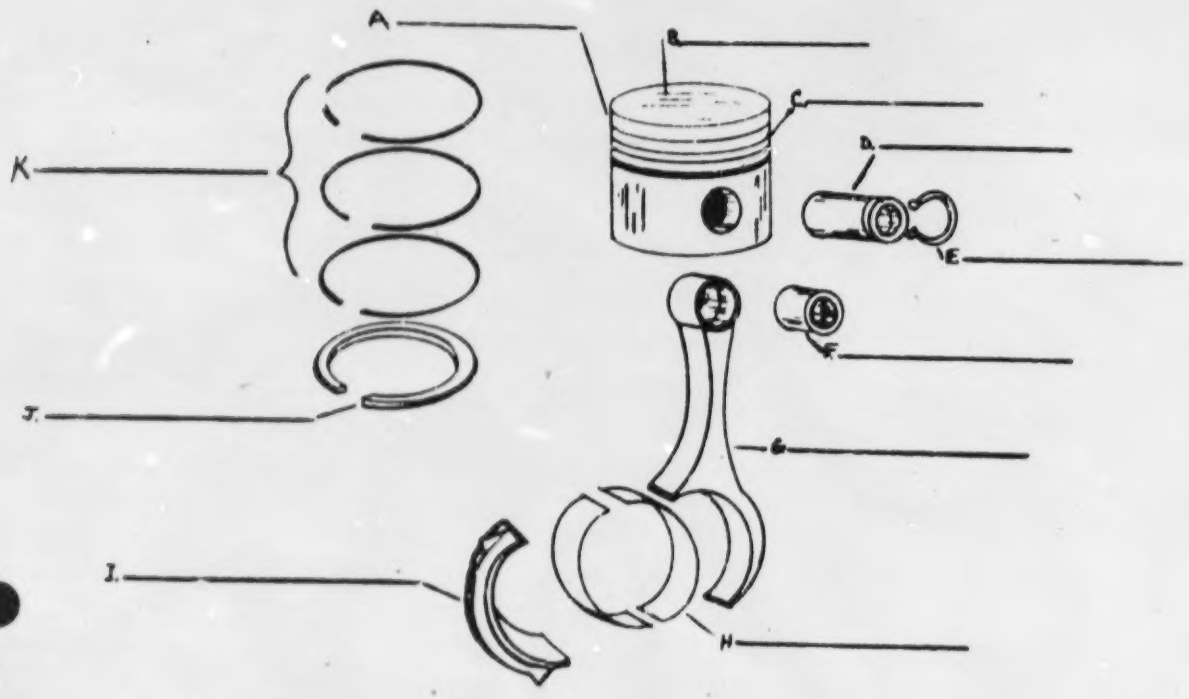
4. What is the function of the oil control ring?

5. List five causes of oil consumption and blow-by due to piston assembly.
   a.
   b.
   c.
   d.
   e.

6. After the piston has been cleaned you should examine the piston for _____.

7. Why should you thoroughly lubricate the piston and rings prior to installation?

8. Label the following diagram.



REMOVE PISTON ASSEMBLY

Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before going on to the next Learning Activity.

k. Oil ring
j. Bearing shells (insert)
i. Connecting rod cap
h. Pin bushing
g. Pin retainer
f. Piston pin
e. Ring grooves
d. Connecting rod
c. Compression ring
b. Piston
a. Top land

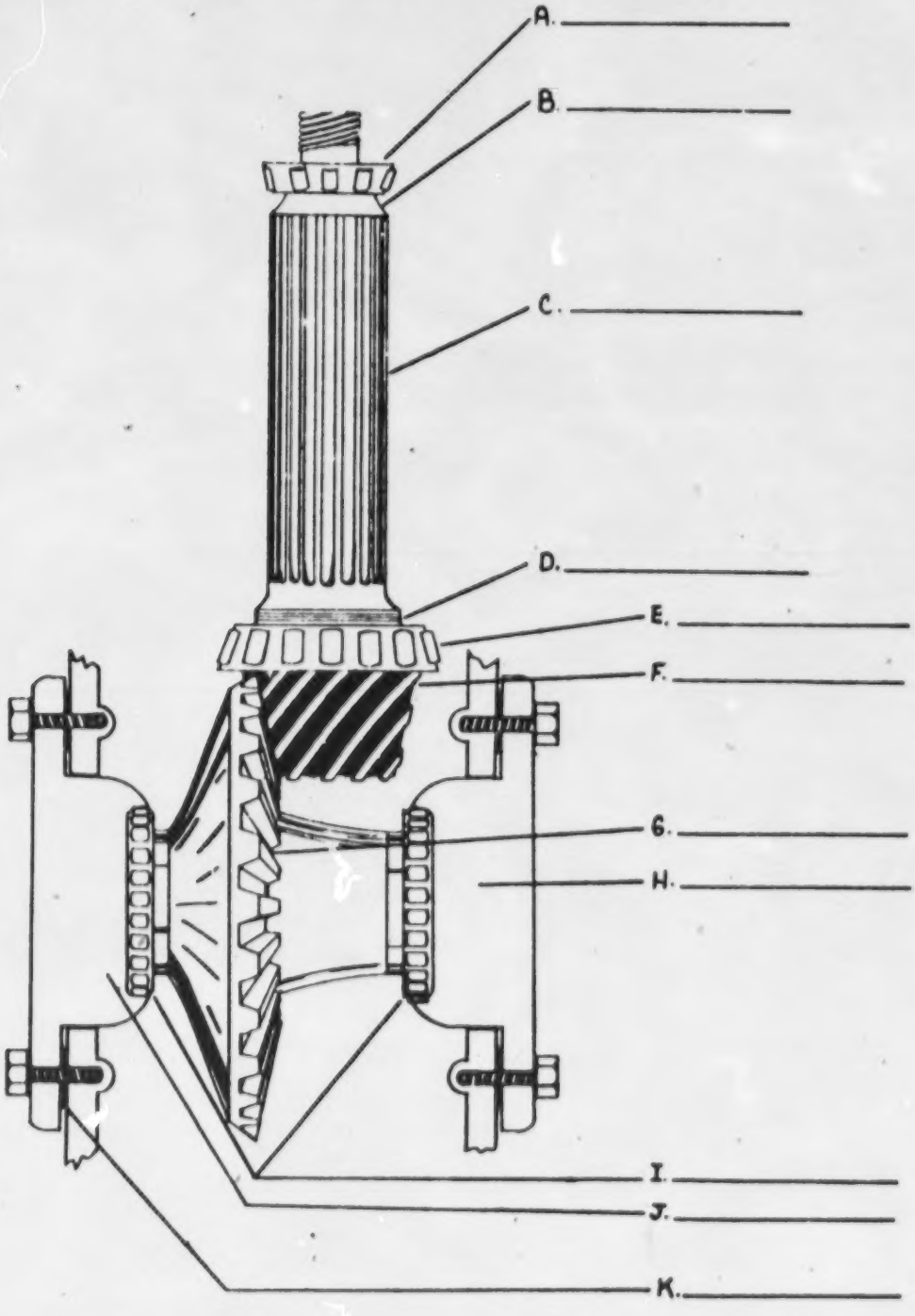
8. Lubrication system supplies oil to all moving parts.
7. Several revolutions may be necessary in a dry engine before the
6. Score marks, damaged ring grooves, signs of overheating
   e. Physical damage to piston
   3. Corrosive wear
   2. Scuffing and scouring
   1. Abrasive wear
   d. Overall wear in piston, rings, and cylinder:
   c. Top ring broken or groove worn
   b. Stuck rings or plugged oil ring
5. a. Piston rings installed wrong
4. To wipe the excess oil from the cylinder wall.
   stroke.
   gases from leaking by the piston during the compression and power
3. They seal by expanding out against the cylinder wall to prevent
   cylinders.
   better fit since the parts are already "wear fitted" to their own
2. To be sure they are installed in the same cylinder. This gives a
1. False; Replace all rings regardless of the condition

CORRECT RESPONSES

*Courtesy of the Kentucky Bureau of Vocational Education, State Department of Education and the Department of Education, College of Education, University of Kentucky.

This self-test is to be used along with the Competency Sheet - CORRECT THE ADJUSTMENT OF THE RING-GEAR AND PINION*

1. Label the parts of a ring gear and pinion on the following diagram.



## CORRECT THE ADJUSTMENT OF THE RING-GEAR PINION

2. What is the backlash adjustment?

3. Looseness in a power train from end to end is called

   _____.

4. What causes too much endplay in gears and shafts?

5. How would you adjust endplay?

6. How would you adjust too much backlash?

7. Why do you preload bearings?

Compare your answers with the correct responses at the bottom of this page. Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. A. upper bearing
   B. shime
   C. shaft
   D. shims
   E. lower bearing
   F. pinion
   G. ring gear
   H. right quill
   I. left quill
   J. quill bearings
   K. shims

2. Clearance or "play" between gear teeth.
3. Endplay
4. It is caused by lack of bearing support for the thrust produced by the gears rotating.
5. By using shims or adjusting nuts.
6. Shims
7. To offset the thrust of the power train.

*Courtesy of the Bureau of Vocational Education, State Department of Education, and the Department of Vocational Education, College of Education, University of Kentucky.

This self-test can be used along with the Competency Sheet -
INSTALLING THE TIMING GEAR OR CHAIN*

Check your knowledge of timing chains of gears by answering the following.

1. The crankshaft is the "hub" around which other parts of the engine can be timed. (True or False)

2. Which of the following accessories are not operated through the timing gear?

   a. Fuel pumps
   b. Turbocharger
   c. Hydraulic cylinder pumps
   d. Oil pumps
   e. Injection pumps (diesel)
   f. Ventilator pumps
   g. Water pumps

3. How is the timing of gears done?_____
   _____

Compare your answers with the correct responses at the bottom of this page.
Review any incorrect answers before going on to the next Learning Activity.

CORRECT RESPONSES

1. True
2. b and c
3. By matching timing marks when the gears are installed.

*Courtesy of the Kentucky Bureau of Vocational Education, State Department of Education and the Department of Vocational Education, College of Education, University of Kentucky.

This material can be used along with the Competence Sheet -
WRITE A PERSONAL DATA SHEET*

Personal Data Sheet

Name _____

Address _____

Age _____ Weight _____ Height _____

General Health _____

Phone Number _____

Job Objective: (State clearly the kind of position, program, or area you are interested in) _____

_____

_____

_____

Education:

High Schools _____

Major _____

Technical Skills _____

_____

_____

Leadership Activities: _____

_____

_____

Work Experien e: (Briefly list jobs held, employers' names and addresses, length of service for each. Begin with present or last job first).

_____

_____

_____

_____

_____

Personal Data Sheet

References: (If possible, include a business, education, and personal reference. Get permission to use names)

_____

_____

_____

_____

_____

_____

*Courtesy of the Virginia Polytechnic Institute and State University, Agriculture Education Department, Blacksburg, Va., in cooperation with the Agriculture Education Service, Division of Vocational Education, State Department of Education, Richmond, Virginia.

This material can be used along with the Competency Sheet - PREPARE FOR A JOB INTERVIEW*

Some Frequently Asked Questions During the Interview

1. What are your future vocational plans?
2. In what school activities have you participated?
3. How do you spend your spare time? What are your hobbies?
4. In what type of position are you most interested?
5. Why do you think you might like to work at our company?
6. What jobs have you held? Why did you leave?
7. What course did you like best in school? Least? Why?
8. What do you know about our company?
9. Do you feel that you have received good general training?
10. Why do you feel that you will be successful in your field?
11. What extracurricular offices have you held?
12. What are your ideas on salary?
13. Do you prefer any specific geographic location? Why?
14. How much money do you expect to earn at the age of 20? 35?
15. How did you rank in school?
16. Do you think that your extracurricular activities were worth the time devoted to them?
17. What personal characteristics are necessary for success in your field?
18. What is your father's occupation?
19. Are you looking for a permanent or temporary job?
20. Do you prefer working alone or with others?
21. Can you take instructions without feeling upset?
22. Tell me a story.
23. Are you primarily interested in making money or do you feel that service to your fellowmen is satisfactory pay?

PREPARE FOR A JOB INTERVIEW

24. Do you live with your parents?

25. Can you get recommendations from previous employees?

26. What interests you about our products and services?

27. Do you feel you have done the best scholastic work of which you are capable?

28. How long do you expect to work?

29. Have you ever had any trouble getting along with fellow students?

30. Have you saved any money?

31. Do you have any debts?

32. Do you attend a church?

33. Do you like routine work?

34. What size city do you prefer?

35. What is your major weakness?

36. Will you work hard to get ahead?

37. Are you eager to please?

38. What do you do to get in good physical condition?

39. Have you had serious illnesses or injuries?

40. Are you willing to relocate if the company wishes?

41. What job in the company would you like most to have?

42. Is it difficult for you to get along with people who have different backgrounds and interests than you?

43. Do you use liquor? How much?

44. Should an employer consider your grades? Why?

45. Would you be willing to work overtime? How much?

46. Do you possess any special skills or abilities?

47. What have you done that indicates initiative and a desire to work?

PREPARE FOR A JOB INTERVIEW

48. You have a complaint about your job or working conditions. How would you handle it?

49. You and a fellow worker are having differences about your jobs. What would you do?

50. You have an idea you feel will help the company. What would you do?

*Courtesy of the Virginia Polytechnic Institute and State University, Agriculture Education Department, Blacksburg, Va., in cooperation with the Agriculture Education Service, Division of Vocational Education - State Department of Education, Richmond, Va.

This material can be used along with the Competency Sheet - PREPARE FOR A JOB INTERVIEW*

Check List to be Used Before Going for an Interview

1. Did I plan ahead for the interview_____?
2. Am I nervous when I meet people_____?
3. Do I ask intelligent questions_____?
4. Do I become tense when asked questions_____?
5. Am I highly emotional_____?
6. Do I take pride in my appearance_____?
7. Do I listen when someone else is talking_____?
8. Do I look at the speaker_____?
9. Do I practice good posture_____?
10. Do I use proper English_____?
11. Do I think before answering_____?
12. Do I answer honestly_____?

*Courtesy of the Virginia Polytechnic Institute and State University, Agriculture Education Department, Blacksburg, Va., in cooperation with the Agriculture Education Service, Division of Vocational Education, State Department of Education, Richmond, Va.

This material can be used along with the Competency Sheet - PREPARE FOR A JOB INTERVIEW*

## Things to Remember at the Interview

1. Sit up straight.
2. Speak in a quiet, pleasant voice.
3. Try to answer all questions correctly.
4. Never talk about personal problems.
5. Be respectful.
6. Use your best English at all times.
7. Know or write down the questions you wish to ask during the interview.
8. Never smoke or chew gum during the interview.
9. Inquire as to what follow-up procedure is required.
10. School subjects you liked best, extracurricular activities.
11. Your educational plans.
12. Ask some questions about the firm.
13. If you've ever been employed, be able to list employer, name of firm, date employed, address, salary, and reason for leaving.

*Courtesy of the Virginia Po. echnic Institute and State University, Agriculture Education Department, Blacksburg, Va., in cooperation with the Agriculture Education - State Department of Vocational Education, Richmond, Va.

This self-test can be used along with the Competency Sheet -
COMPLETE A JOB APPLICATION

APPLICATION FOR EMPLOYMENT

PERSONAL INFORMATION

Print Name Mr. Ms.

Last First Middle

Address:

No. and Street

City State Zip Code

Telephone: ( ) Social Security No. - -

Area Code No.

Is Your Age (check one) under 18____ 18-65____ over 65 ____

Are you a citizen of the U.S.A.? ___Yes___No

If you are not a citizen of the U.S.A., do you have a legal right to remain permanently in the U.S.?___Yes ____No

JOB INTEREST

Position Desired: | Date Available:

Wages or salary expected $ Per Hr. Wk. Mo.

Other Work for Which you are Qualified

Willing to Work Night Shift Yes No

Have You Ever Applied For A Security Clearance? Yes No

Have You Ever Been Granted A Security Clearance?____Yes ____No

Type of Clearance Granted:

U.S. MILITARY HISTORY

Branch Date Entered / / | Date Discharged / /

Rank When Discharged

Armed Forces Reserve Brance or National Guard____Active___Inactive

List Any Special Skills Acquired While In U.S. Armed Forces

EDUCATIONAL BACKGROUND

| School Name and Address of School Include Grade School, High School, Trade School, College or Business School, Night School, Correspondence School, Other | Dates of Attendance | | Diploma, Degree or Certificate | Course of Specialty |
|---|---|---|---|---|
| | From | To | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

SCHOOL ACTIVITIES

| Sports: | Student Government: List Others |
|---|---|
| | |

Clubs or Fraternities (Sororities): List Offices

Honorary Clubs:

Academic Honors:

EMPLOYMENT HISTORY

Please Cover Employment for Past 10 Yrs.
Including U. S. Military

| Date | Name & Address Employer | 1. Job Title<br>2. Department<br>3. Name of Supervisor | Describe Major Duties | Wages | Reason For Leaving |
|---|---|---|---|---|---|
| From<br>_____<br>Mo. Yr.<br>To<br>_____<br>Mo. Yr. | | 1.<br>2.<br>3. | | Starting<br>$____per<br>Final<br>$____per | |
| From<br>_____<br>Mo. Yr.<br>To<br>_____ | | 1.<br>2.<br>3. | | Starting<br>$____per<br>Final<br>$____per | |

REFERENCES

Please Give Professional and Personal References

| Name (First, Middle, Last) | Address (Street, City, State) | Occupation (Position or Title) |
|---|---|---|
| | | |
| | | |
| | | |

PRE-EMPLOYMENT STATEMENT

I voluntarily give this Company the right to make a thorough investigation of my past employment and activities, agree to cooperate in such investigation, and release from all liability or responsibility all persons, companies or corporations supplying such information.

I consent to taking the pre-employment physical examination and such future physical examinations as may be required by the Company. I agree to wear or use protective clothing or devices as required by the Company and to comply with the safety rules.

If employed by the Company, I understand that this employment is subject to the security policies of the Company. I further understand that if the position for which I am hired requires access to classified information and I am not able to obtain a security clearance, I will not be allowed to work in this position. My employment with the Company in a position not requiring security clearance depends upon the existence of such a position for which I am qualified.

I further understand that any false answers or statements made by me on this application or any supplement therein or in connection with the above mentioned investigation will be suffient grounds for immediate discharge.

Applicant's Signature _____ Date _____

This self-test can be used along with the Competency Sheet -
COMPLETE A JOB APPLICATION

Define the following terms -

1. Nationality - _____
2. Guardian - _____
3. Marital status - _____
4. Number of dependents - _____
5. Ethnic group - _____
6. Limitations - _____
7. Capabilities - _____
8. Compensation - _____
9. Naturalized citizen - _____
10. Natural born citizen - _____
11. Fringe benefits - _____
12. Wage - _____
13. Salary - _____
14. Supervisor - _____
15. Employee - _____
16. Employer - _____
17. O.A.S.I. - _____
18. Deduction - _____
19. Federal withholding - _____
20. State withholding - _____
21. Annuity - _____
22. Gross Pay - _____
23. Take home pay - _____
24. Management - _____
25. Personnel Manager - _____
26. Job interview - _____

This material can be used along with the Competency Sheet - COMPLETE A JOB APPLICATION FORM.

Terms to know to fill out a job application -

1. Nationality - country where a person is born
2. Guardian - person in charge of the legal care of a youth
3. Marital status - single, married, divorced, or widowed
4. Number of dependents - individuals who depend upon you for their support
5. Ethnic group - caucasian (white), negroid, Indian, Asian, other
6. Limitations - health or physical condition that may hinder a person on the job.
7. Capabilities - things you can do well.
8. Compensation - pay for time not able to work.
9. Naturalized citizen - a person who has gone through the legal process to become a U.S. citizen
10. Natural born citizen - a person who is born in a country
11. Fringe benefits - things given an employee other than money
12. Wage - the hourly rate of pay
13. Salary - monthly or yearly contract payments
14. Supervisor - a person who works for another person or company
15. Employee - a person who works for another person or company
16. Employer - a person or company who hires another
17. O.A.S.I. - Old Age Survivors Insurance
18. Deduction - that which is taken from a pay check
19. Federal withholding - tax money taken out by the U.S. Government
20. State withholding - tax money taken out by the State Government
21. Annuity - a form of saving money
22. Gross Pay - the total amount paid before deductions
23. Take home pay - the amount that is taken home
24. Management - those who make decisions
25. Personnel Manager - person who is in charge of people
26. Job interview - the person to person contact between employee and employer

## EQUIPMENT AND TOOLS

Aligner, Connecting Rod
Anvil
Bars, Wrecking and Utility
Battery Bulb Filler
Battery Carrying Strap
Battery Cell Tester
Battery Charger
Battery Hydrometer
Battery Jumper Cables
Battery Terminal Cleaner
Battery Terminal Lifter
Bushing Driver Set
Chisels, Assorted
Clamps, Assorted
Cleaner, Piston Groove
Cleaner, Steam
Compressor, Air
Compressor, Piston Ring
Compressor, Valve Spring
Creeper
Cutter, Bolt
Dial Indicator Test Set
Drill, Portable Electric (½" and ¼")
Drill Press, Floor
Drill Press, Hydraulic
Drill Sharpening Attachment
Dynamometer
Extension Cord
Face Shield
Files, Assorted
Fire Extinguisher
First Aid Kit
Gauge, Feeler
Gauge, Fuel Pressure
Gauge, Spark Plug
Gauge, Vacuum
Grinder, Bench
Grinder, Valve
Grinder, Portable Electric
Grinder, Valve Face
Grinder, Valve Seat Kit
Grinding Wheel Dresser
Growler
Hacksaw
Hammers, Ball Pein
Hammer, Sledge
Hammers, Soft-Faced
Hoist, Chain
Hoist, Portable
Hone, Cylinder
Hydrometer
Indicator, Dial
Instrument, Alternator-Regulator Tester
Instrument, Amps Volts Regulator Tester
Instrument, Compression Gauge
Instrument, Diesel Nozzle/Injector Tester
Instrument, Diesel Pump Calibrating Stand
Instrument, Dwell-Tachometer
Instrument, Exhaust Analyzer
Instrument, Spark Plug Cleaner-Tester
Instrument, Timing Light
Jack, Hydraulic
Jack, Tricycle Stand
Lathe, Armature
Mallet, Rubber
Micrometer Set
Paint Spray Filter and Regulator
Paint Spray Gun
Parts, Washer
Pliers, Miscellaneous
Press, Arbor
Pullers, Wheel
Punches, Assorted
Reamer, Ridge
Rule
Sander, Portable Disc
Screwdrivers, Miscellaneous
Screw Extractor Set, 1/4" - 7/8"
Seat & Tool Tray
Socket Set, 1/2" Drive
Socket Set, 3/8" Drive
Socket Set, 1/4" Drive
Socket Set, 3/4" Drive
Soldering Iron
Speed Indicator
Stand, Engine
Stands, Jack
Tap and Die Set, 1/4" to 3/4"
Tin Snips, 12"
Tire Changer

Tire Irons
Torch, Cutting
Trouble Lights
Tubing Tools, Cutter, Flarer, Etc.
Twist Drill Set
Valve Spring Compressor
Vise, Machinist's 4" Jaw
Vise, Machinist's 5" Jaw
Welder, Arc
Welder, Oxy-Acetylene
Wire Brush
Wrench Kit, Impact
Wrench Set, Box End
Wrench Set, Combination
Wrench Set, Ignition
Wrench Set, Open End
Wrench, Torque
Wrenches, Adjustable
Wrenches, Allen Set/Miscellaneous
Boring Bar
Square and Level
Pipe Wrenches
Plastic Gauge for Checking Bearing Clear
Coil and Condenser Tester
Brake Bleeder
Bushing Hone (Master Cylinder, Wheel Cyl.)
Bearing Load Tester, Pounds Pull Gauge
Hydraulic Test Equipment, Gauges, Flo-Rate
Sleeve Puller
Valve Seat Cutter
Hot Tank Cleaner
Parts Cleaner
Scales
Weight
Reamers (Specialized)
Pilot Tools
Pipe Dies
Snap Ring Pliers
Hard Surfacing, Carbon Arc and Acetylene
High Pressure Washer
Drill Press, Floor Model
Clutch Adjusting Tools
Hammer For Breaking Tires
Band Saw (Metal)
Stacon Pliers, Connection
Charts on MM to Inches
Lathe, Table
Electrical Short T ster
Test Light, 12 V to 6V
Massey Ferguson Special Tools
Hydraulic Pressure Gauges
Oil Sucking Gun
Diesel Engine Compressor Tester
Gasket Hole Cutter
Slide Hammer Puller
Pump for Repairing Tires
Tractor Lift
Brake Tools
Hydraulic Pump Rebuilding Tools
Adjustable Stands
Fluid Pump, Tire
Milling Machine
Woodruff Key Cutter
Cylinder Head Grinder
Saw Chain Sharpener, Grinder
Clutch Lining Tools
Nut Crackers
Riveting Machine
Oil and Grease Seal Drivers
Special John Deere Tools
Magnets
Air Chisel

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